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ASSESSMENT OF BIM TOOLS AND SOFTWARE ON WORKING DRAWING AND SPECIFICATION IN THE NIGERIAN CONSTRUCTION INDUSTRY

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ABSTRACT :

This study investigates the influence of Building Information Modelling (BIM) tools and software on the development and quality of working drawings and specifications within Nigeria's construction industry. With the growing demand for accurate, coordinated, and efficient documentation, the study evaluates the extent to which BIM technologies enhance the preparation of construction documents compared to traditional methods. Using a quantitative survey approach, data was collected from 539 construction professionals across Nigeria, including architects, engineers, and project managers. The findings reveal a significant adoption of BIM tools for design coordination, detailing, and specification management, with positive impacts on drawing accuracy, interdisciplinary collaboration, and reduction of project errors. However, the study also identifies barriers such as limited technical expertise, high implementation costs, and inadequate regulatory support, which affect broader adoption. Results emphasize the critical need for industry-wide BIM integration and capacity building to optimize documentation standards. The research contributes to the understanding of how BIM transforms technical documentation practices and advocates for improved training, policy alignment, and investment in digital tools. Therefore, highlighting the comparative advantages of BIM-enabled workflows, this study provides insights for stakeholders aiming to enhance construction quality, mitigate errors, and streamline project delivery in Nigeria's evolving built environment.

Keywords: Building Information Modelling (BIM), Construction specification, Digital construction tools, Nigerian construction industry, Working drawings

1.0 INTRODUCTION

This chapter lays the foundation for the research by presenting the background, relevance, and focus of the study. It highlights the growing importance of Building Information Modelling (BIM) in enhancing construction documentation, particularly working drawings and specifications. As the Nigerian construction industry faces increasing pressure to improve accuracy, coordination, and project outcomes, BIM has emerged as a digital innovation capable of transforming traditional design and documentation practices (Oladayo, Olanipekun, & Ipinlaye, 2024). While global adoption has been significant, the Nigerian context remains marked by slow uptake, inconsistent implementation, and limited digital proficiency among construction professionals (Okereke, Muhammed, & Eze, 2021; Adewumi, Onamade, Asaju & Adegbile, 2023; Adewumi, Onamade, Onyikeh, Otuonuyo, Alagbe, Adegbile & Dayomi, 2025b).

Working drawings and specifications form the backbone of construction documentation. Working drawings communicate precise graphical information required for project execution, while specifications provide detailed descriptions of materials, workmanship standards, and performance expectations (Adewumi, Onamade, David- Mukoro, Bamiloye, Otuonuyo, Chukwuka & Oru, 2025; Owolabi, Harry, Adewumi, Onamade & Alagbe, 2024). BIM tools and software offer integrated platforms that enhance these functions through automation, intelligent modeling, and interdisciplinary coordination. Studies have emphasized how BIM technologies improve documentation accuracy, reduce errors, and support efficient decision-making throughout the project lifecycle (Gustian, Milyardi, & Lesmana, 2022; Emesiobi, Otuonuyo, Adewumi, Asaju & Onamade, 2024).

However, despite these advantages, the adoption of BIM for working drawings and specifications in Nigeria faces multiple challenges, including high software costs, inadequate training, lack of standardized workflows, and resistance to change (Okereke et al., 2021; Oladayo et al., 2024). While there is growing awareness of BIM's potential, its practical application in documentation processes remains limited to a few high-end firms, and even then, inconsistently applied across project phases. This has raised concerns over the effectiveness of BIM in advancing documentation standards and quality assurance within the local construction industry.

This study assesses the extent to which BIM tools and software are influencing the preparation and management of working drawings and specifications in Nigeria. It evaluates the level of adoption among professionals, identifies key challenges, and explores how BIM integration affects quality, efficiency, and project communication.

Despite the global shift towards digital construction documentation, many Nigerian firms continue to rely heavily on manual or semi-digital practices, limiting the benefits associated with real-time data coordination, clash detection, and collaborative planning (Adewumi, Asaju, Bello, Atulegwu, Ibhafidon, David- Mukoro, Otuonuyo & Ogunyemi, 2025a). Previous studies have focused broadly on BIM adoption; however, limited empirical evidence exists on its specific impact on documentation practices, particularly in developing construction economies like Nigeria (Alagbe, Otuonuyo, Adewumi, Onamade & Asaju, 2024; Gustian et al., 2022; Okereke et al., 2021). This study seeks to bridge this gap by offering a focused analysis of BIM's role in shaping the production and effectiveness of working drawings and specifications.

The aim of this study is to assess the impact of BIM tools and software on the quality and effectiveness of working drawings and specifications in the Nigerian construction industry. While the Objectives are to:

1) examine the extent to which BIM tools are adopted in the preparation of working drawings and specifications in Nigeria;
2) evaluate the perceived benefits and challenges associated with the use of BIM in construction documentation; and
3) identify gaps in training, standardization, and professional practice that affect BIM implementation for drawings and specifications.

This study holds significance for architects, engineers, project managers, regulatory bodies, and academic institutions. Therefore, evaluating how BIM tools impact the development of construction documentation, the findings will inform policy decisions, capacity-building programs, and future research (Asaju, Adewumi, Onamade & Alagbe, 2024; George, Adewumi, Otuonuyo, Oyewole, Oparinde & Yusuf, 2025. The research also offers practical recommendations for improving BIM integration in the Nigerian construction context, such as promoting standard templates, investing in professional training, and encouraging collaborative workflows (Hassan, Adewumi & Olukunga, 2024). Ultimately, enhancing the use of BIM in working drawings and specifications can improve construction accuracy, reduce project waste, and promote innovation in the built environment (Adewumi et al., 2025; Emesiobi et al., 2024; Owolabi et al., 2024).

Given the increasing demand for efficient, accurate, and integrated construction documentation, this study is timely in evaluating how BIM tools and software influence the production of working drawings and specifications in Nigeria's construction industry. The insights derived will be instrumental for architects, project managers, policymakers, and construction professionals seeking to optimize design coordination, reduce documentation errors, and enhance construction quality through digital processes (Oladayo, Olanipekun, & Ipinlaye, 2024; Emesiobi et al., 2024). Furthermore, understanding the current limitations and practical benefits of BIM use in the Nigerian context will help bridge the knowledge gap and support the development of training frameworks and implementation strategies tailored to local industry needs (Okereke, Muhammed, & Eze, 2021; Gustian, Milyardi, & Lesmana, 2022). Ultimately, the findings will contribute to the digital transformation of the sector by encouraging widespread BIM adoption, thereby improving project delivery standards, promoting specification clarity, and fostering innovation across construction practices in Nigeria.

2.0 LITERATURE REVIEW

In recent decades, the construction industry has undergone rapid technological transformation globally, driven by the increasing demand for efficiency, precision, and sustainability across all phases of project delivery (Adewumi et al., 2023; Owolabi et al.,2024). One of the most impactful innovations in this regard is Building Information Modelling (BIM), a digital process that enables the generation and management of intelligent data-rich models that span the design, construction, and operational phases of buildings and infrastructure (Oladayo, Olanipekun, & Ipinlaye, 2024). BIM has gained international recognition for its ability to enhance collaboration, reduce errors, support accurate decision-making, and improve the overall performance of construction projects (Alugbue et al., 2024; Adewumi et al., 2025). Particularly, BIM tools have shown potential in improving the production and coordination of working drawings and specifications two critical components of construction documentation that directly influence project quality, timelines, and cost efficiency (Gustian, Milyardi, & Lesmana, 2022; Emesiobi et al., 2024).

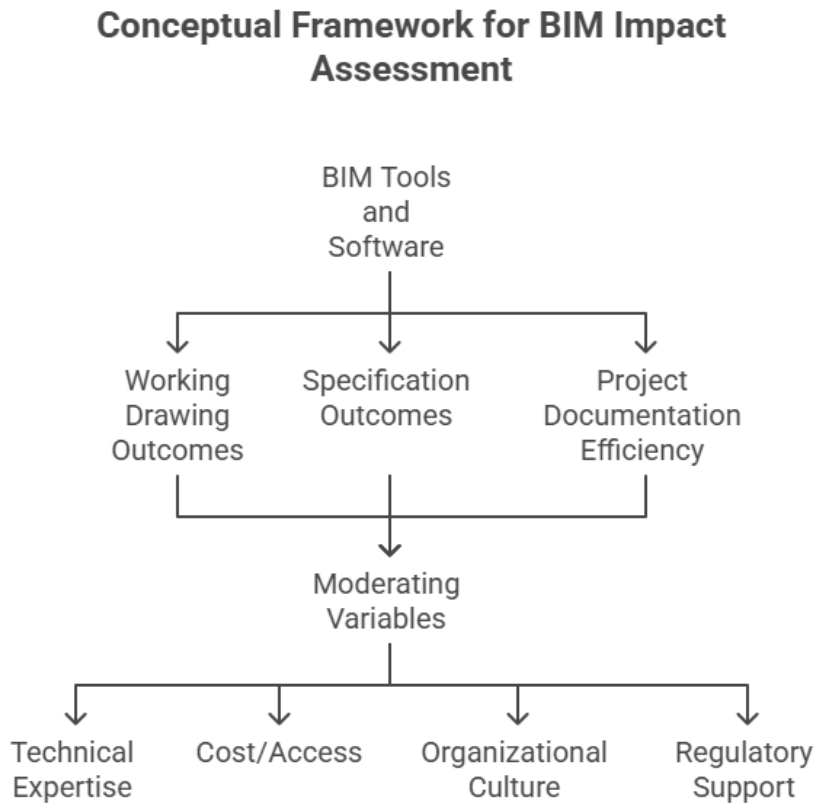
Working drawings and specifications form the technical backbone of any construction project, translating design intent into actionable instructions for contractors, consultants, and other stakeholders. While working drawings convey visual and dimensional aspects of construction elements, specifications provide comprehensive written descriptions covering materials, workmanship standards, performance criteria, and regulatory compliance expectations (Adewumi et al., 2025; Owolabi, et al., 2024). The quality and coordination of these documents significantly influence construction accuracy, cost control, and quality assurance. However, in the Nigerian construction industry, the preparation of these documents often remains manual or semi-digital, leading to a high incidence of inconsistencies, omissions, and duplication of effort (Emesiobi et al., 2024). Despite growing awareness of BIM's benefits, Nigeria's construction sector continues to face major adoption barriers including the high cost of software licenses, lack of training and technical expertise, limited institutional support, and cultural resistance to change (Okereke, Muhammed, & Eze, 2021). These limitations have impeded the full integration of BIM into everyday project workflows, particularly in the areas of construction documentation where automation and real-time updates could greatly improve drawing accuracy and specification reliability. In practice, most construction firms still rely on disconnected tools and linear workflows, which increase the likelihood of errors during design coordination, tendering, and on-site implementation (Owolabi et al., 2024; Adewumi et al., 2025a).

BIM tools such as Autodesk Revit, ArchiCAD, and Navisworks are designed not only to streamline 3D modeling but also to support specification management and drawing production in a synchronized environment. Through intelligent parametric modeling, these tools enable seamless integration between graphical and non-graphical data, ensuring that any changes to the model are automatically reflected across schedules, drawings, and specifications (Gustian et al., 2022). This capability reduces design conflicts, minimizes rework, and supports standard compliance. While countries like the UK and Singapore have implemented national BIM mandates and seen significant improvements in documentation practices and project outcomes, Nigeria's progress remains slow and fragmented (Oladayo et al., 2024; Adewumi et al., 2025b).

2.1 Conceptual Framework

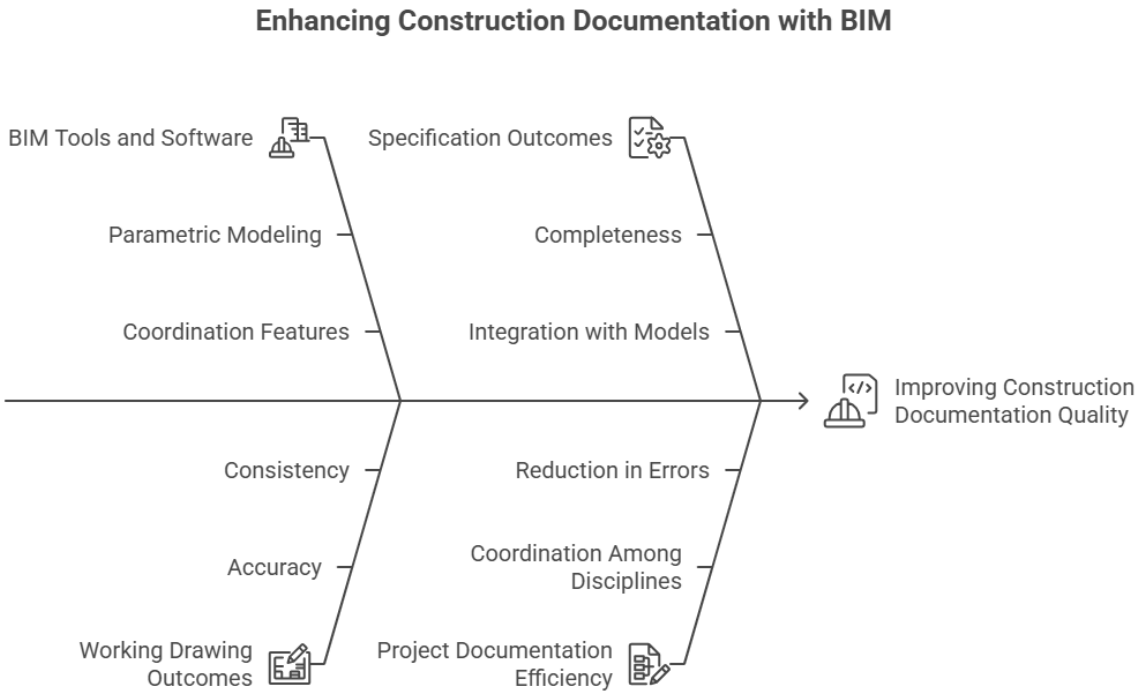
This study is anchored on a conceptual framework that evaluates how Building Information Modelling (BIM) tools and software affect the accuracy, integration, and overall efficiency of working drawings and specifications in the Nigerian construction industry. BIM is conceptualized not merely as a drafting solution, but as a process-oriented technology that connects design, documentation, and project delivery through intelligent, data-rich models (Oladayo, Olanipekun, & Ipinlaye, 2024). Traditionally, working drawings and specifications are developed in silos, resulting in documentation discrepancies, miscommunication, and increased rework, especially in Nigeria where digital workflows are still emerging (Owolabi et al., 2024). BIM tools such as Revit, ArchiCAD, and Navisworks offer synchronized environments that support real-time updates, specification linking, and cross-disciplinary coordination, which can substantially improve documentation consistency and project delivery outcomes (Gustian, Milyardi, & Lesmana, 2022). The framework further accounts for internal and external factors that mediate the adoption and impact of BIM tools on construction documentation. Internally, variables such as professional expertise, access to BIM-enabled infrastructure, and institutional readiness shape the extent to which BIM enhances drawing and specification quality (Emesiobi et al., 2024; George et al., 2025). Externally, systemic issues such as high software licensing costs, limited BIM-focused training, and absence of supportive policy environments continue to hinder BIM implementation (Okereke, Muhammed, & Eze, 2021). Government mandates, curriculum reforms, and stakeholder engagement are thus recognized as critical enablers for translating BIM's potential into practical documentation improvements (Adewumi et al., 2025; Alugbue et al., 2024). This conceptual model guides the investigation by illustrating the dynamic interaction between BIM use (independent variable), documentation outcomes (dependent variables), and moderating conditions, providing a foundation for evaluating how BIM can be better utilized to optimize technical documentation in Nigeria's construction sector (Hassan et al., 2024; Asaju et al., 2024).

Figure 1: Conceptual Development Framework



Source: Research Fieldwork (2025)

Figure 7: Enhancing Construction Documentation with BIM



Source: Research Fieldwork (2025)

2.2 Theoretical Framework

This study is anchored on two interrelated theories: Quality Management Theory (QMT) and Construction Industry Best Practices (IBP), both of which provide a strong foundation for understanding how Building Information Modelling (BIM) tools and software influence the development and integration of working drawings and specifications in construction projects.

Quality Management Theory emphasizes systematic process control, continuous improvement, and customer satisfaction as core principles in achieving consistent project outcomes (Adewumi et al., 2025). Within the built environment, QMT stresses that clearly defined documentation particularly through precise working drawings and technical specifications is central to ensuring quality assurance, effective communication, and project accountability (Owolabi et al., 2024; Alugbue et al., 2025a). BIM tools, when integrated into the documentation workflow, support these principles by minimizing human error, enabling real-time updates, enhancing traceability, and ensuring that specifications are embedded within model elements rather than existing as disconnected text (Emesiobi et al., 2024; Alugbue et al; 2024). Moreover, BIM facilitates the testing of materials, methods, and performance criteria in a virtual environment, allowing for early identification of inconsistencies, which aligns with the preventive ethos of QMT that prioritizes defect avoidance over correction.

Figure 3: Total Quality Management model for Quality Assurance

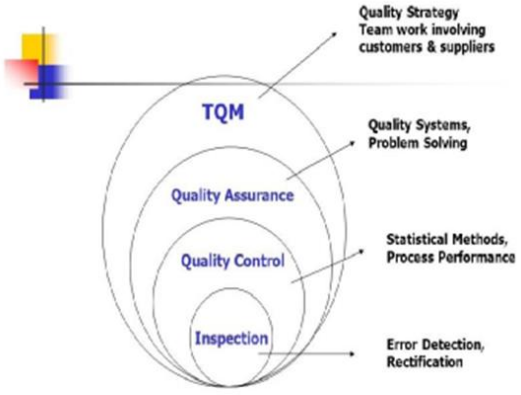


Figure 1: Total Quality Management model for Quality Assurance

Source: Owolabi et al., 2024

Additionally, this study draws from the Construction Industry Best Practices (IBP) framework, which consolidates knowledge derived from global construction standards, industry experience, and research-driven innovations. IBP advocates for the use of integrated systems, smart technology, and collaborative tools that promote project efficiency, cost control, and stakeholder engagement (Emesiobi et al., 2024). BIM exemplifies these best practices by offering an interoperable platform where working drawings, construction specifications, and material data are digitally linked, accessible, and editable across disciplines (Gustian, Milyardi, & Lesmana, 2022). The ability of BIM tools to streamline communication and improve drawing accuracy directly supports the best practice goal of reducing rework, saving time, and improving construction outcomes (Oladayo, Olanipekun, & Ipinlaye, 2024). In the Nigerian context, where fragmented documentation and weak specification practices are prevalent, IBP becomes an essential guiding theory that underscores the need for digital transformation in project documentation (Alugbue et al., 2024). By combining these two theoretical perspectives, the study conceptualizes BIM as a technology-driven quality management tool that can bridge the gap between design intent and construction reality. QMT provides the philosophical and process-oriented lens to evaluate how BIM improves standardization, accuracy, and specification clarity, while IBP offers a pragmatic outlook for assessing how BIM aligns with global trends in documentation excellence and collaborative delivery. These theories collectively reinforce the relevance of investigating BIM's influence on documentation practices, particularly working drawings and specifications, as a pathway to achieving higher performance, reduced risk, and improved construction quality in Nigeria's evolving built environment (Adewumi et al., 2023; Hassan et al., 2024).

2.3 Empirical Review

Despite the acknowledged advantages of Building Information Modelling (BIM) tools in enhancing design precision and construction documentation globally, their application within Nigeria's construction industry remains limited, particularly in the preparation of working drawings and technical specifications. In a comprehensive study, Oladayo, Olanipekun, and Ipinlaye (2024) emphasized that although BIM has gained global traction due to its capacity for real-time collaboration and intelligent modeling, Nigeria's construction sector still operates in a "BIM infant stage," primarily hindered by high software costs, professional resistance to digital transformation, and a comfort with traditional drafting methods. Similarly, Gustian, Milyardi, and Lesmana (2022), in their evaluation of Indonesian contractors, observed comparable constraints, identifying lack of training, high licensing fees, and inadequate hardware infrastructure as the most dominant barriers across top- and middle-class contractors. Their findings underscore that while the perceived benefits of BIM—such as improved modeling quality, documentation accuracy, and enhanced decision-making—are widely recognized, the challenges of implementation often overshadow its potential.

Okereke, Muhammed, and Eze (2021) further explored these limitations in Nigeria by assessing BIM's potential benefits among construction professionals in Port Harcourt. Their study concluded that although awareness of BIM is relatively high, actual usage is low due to technical knowledge gaps and institutional inertia. Nonetheless, respondents acknowledged BIM's effectiveness in reducing construction errors, minimizing design clashes, and supporting better project coordination. In a similar vein, Adewumi et al. (2025) analyzed the role of specifications in quality assurance and argued that digital specification tools embedded within BIM environments could drastically reduce ambiguity and misinterpretation during construction. However, they noted that most professionals in Nigeria still prepare specifications in isolation from their working drawings, leading to documentation inconsistencies and frequent rework.

In Lagos State, Alugbue et al. (2024) examined the broader impact of specifications on construction administration and found that while professionals integrated specifications into design workflows, challenges persisted in terms of software compatibility, inter-professional collaboration, and regulatory enforcement. Their study emphasized that without BIM-supported documentation standards, coordination failures between drawing outputs and material specifications are inevitable. Echoing these findings, Owolabi et al. (2024) highlighted how BIM could act as a quality assurance tool by integrating specification and performance criteria directly into working drawings. However, they stressed that current practices in Nigeria remain largely manual, undermining the efficiency and accuracy that BIM tools are designed to deliver.

Finally, Emesiobi, Otuonuyo, Adewumi, Asaju and Onamade (2024) provided insight into BIM's potential from a facility management perspective. Their research revealed that the absence of embedded specification data within building documentation often leads to increased operational costs and maintenance inefficiencies. They advocated for preventive maintenance practices driven by BIM-based specifications, which could improve long-term infrastructure performance, especially in megacities like Lagos. However, the study also acknowledged that limited policy support and poor digital integration continue to hamper this possibility in Nigeria.

Collectively, these empirical studies converge on a central issue: although BIM tools and software offer substantial benefits in improving working drawing accuracy, integrating specifications, and enhancing documentation consistency, their application in Nigeria is constrained by a combination of financial, technical, and institutional barriers. This reinforces the need for targeted research and intervention strategies aimed at addressing BIM-specific challenges, particularly in relation to its adoption for working drawing and specification development across Nigeria's evolving construction industry.

Gaps in Literature

This section outlines the major research gaps in the existing literature on the assessment of BIM tools and software in the development of working drawings and specification documents in the Nigerian construction industry. While prior studies address BIM adoption at a general level, they do not sufficiently examine the implications for documentation processes that are critical for quality and compliance. Some of these gaps are outlined below:

- There is lack of Focused Empirical Studies on BIM and Construction Documentation: Most existing studies, such as Oladayo, Olanipekun, and Ipinlaye (2024), provide a broad review of BIM adoption in Nigeria, but fail to delve into how BIM specifically influences the generation of working drawings and specification writing processes in real project settings.
- There is an insufficient Exploration of Software-Specific Impact: Although Gustian, Milyardi, and Lesmana (2022) assessed BIM implementation among contractors, there is little investigation into how tools like Revit or ArchiCAD improve coordination between design elements and technical documentation in Nigerian construction practice.

- There is a contextual Gaps in BIM Use for Working Drawings: Despite the relevance of BIM for drawing accuracy and design visualization, few studies like Emesiobi, Otuonuyo, and Onamade (2024) have analyzed its real-time application in the Nigerian context, especially regarding how it resolves inconsistencies in traditional 2D documentation workflows.
- There is a disconnection Between BIM and Specification Development: While Adewumi et al. (2025) and Owolabi et al. (2024) underscore the importance of quality assurance through specification writing, they do not empirically connect these practices with the capabilities of BIM to automate and standardize specification processes, leading to a missed opportunity in advancing integrated documentation.

Therefore, this study seeks to fill these gaps by focusing on the underexplored relationship between BIM tools and construction documentation practices in Nigeria, assessing the current usage, constraints, and opportunities for improved delivery of working drawings and specifications.

3.0 METHODOLOGY

This study adopts a quantitative research design to assess the influence of Building Information Modelling (BIM) tools and software on the accuracy, efficiency, and coordination of working drawings and specifications within Nigeria's construction industry. Given the increasing digitalization of architectural documentation and the need for empirical insight into BIM implementation, this approach enables the collection of standardized data across a wide population of construction professionals. The primary instrument for data collection was a structured questionnaire administered to 539 respondents across Nigeria, including architects, contractors, engineers, and surveyors. The questionnaire employed a Likert scale to gauge participants' perceptions of BIM integration, documentation quality, user satisfaction, and digital design capabilities.

The study population was drawn from a mix of sole proprietorships, partnerships, limited liability companies, and corporations, with a majority of participants (87.94%) practicing in Lagos State. Over 32% of respondents were architects, while 14% were contractors and 14% surveyors, ensuring representation across key professional categories. Notably, 27.64% of the participants had 11–15 years of experience handling working drawings, offering insights rooted in professional maturity. Data analysis was conducted using descriptive statistics, including mean score and relative index (RI) to rank key factors affecting BIM application. Questions focused on BIM's ability to improve drawing accuracy, reduce errors, streamline specification writing, and integrate project disciplines. The results were interpreted to reflect the perceived impact of BIM tools such as Autodesk Revit and ArchiCAD on documentation practices. By grounding the analysis in empirical data, the study provides measurable evidence on BIM's current usage and potential in enhancing construction documentation standards in Nigeria. The findings are expected to inform both practice and policy in the ongoing digital transformation of the industry.

4.0 RESULTS AND DISCUSSION

4.1 Demography of Respondents

From a sample size of 539 construction professionals, 51.02% were male and 48.98% were female. The age group most represented was 41–50 years (29.68%), followed by 21–30 years (25.42%), and 31–40 years (20.22%). In terms of marital status, 38.40% of the respondents were married, 29.31% were single, and 17.63% were widowed. Regarding educational attainment, 36.36% held a master's degree, 23.75% a first degree (HND/BSc), and 12.06% a doctorate, indicating that the respondents were largely well-educated.

Professionally, architects comprised the largest group (32.1%), followed by contractors (14.29%), surveyors (14.10%), engineers (11.32%), and other roles in the construction ecosystem. In terms of practice location, Lagos State was overwhelmingly dominant, accounting for 87.94% of participants. Most respondents had 11–15 years (27.64%) or 0–5 years (19.67%) of experience dealing with working drawings, suggesting a good balance between early-career and experienced professionals.

Table 1: What is your gender?

GENDER				
S/N	**Gender**	**N=539**	**percentage (%)**	**Cum %age**
1	Female	264	48.97959184	48.9795918
2	Male	275	51.02040816	100
		539		

Research's Fieldwork (2025)

Table 2: What age range do you fall under?

AGE RANGE				
S/N	**Age**	**Frequency (N=539)**	**Percentage (%)**	**Cum %age**
1	Less than 20 years	71	13.17	13.17
2	21 - 30 years	137	25.42	38.59

3	31 - 40 years	109	20.22	58.81
4	41 - 50 years	160	29.68	88.50
5	51 years & Above	62	11.50	100.00
		539		

Research's Fieldwork (2025)

Table 3: What is your highest academic qualification?

EDUCATION LEVEL				
S/N	**Level of Education**	**N=539**	**percentage (%)**	**cum%age**
1	Below First Degree	78	14.47	14.47
2	First Degree (HND/BSc.)	128	23.75	38.22
3	Master's Degree	196	36.36	74.58
4	Doctorate Degree	65	12.06	86.64
6	Others	72	13.36	100.00
		539		

Research's Fieldwork (2025)

Table 4: Type of firm?

TYPE OF FIRM				
S/N	**FIRM**	**N=539**	**percentage (%)**	**cum%age**
1	Sole Proprietorship	128	23.75	23.75
2	Partnership	149	27.64	51.39
3	Limited Liability	95	17.63	69.02
4	Corporation	87	16.14	85.16
5	Public Liability Company	80	14.84	100.00
		539		

Research's Fieldwork (2025)

Table 5: How many years dealing with working drawing?

YEARS DEALING WITH WORKING DRAWING				
S/N	**Years**	**N=539**	**percentage (%)**	**cum%age**
1	0 - 5 years	106	19.67	19.67
2	6 -10 years	104	19.29	38.96
3	11 -15 years	149	27.64	66.60
4	16-20 years	92	17.07	83.67
5	Above 20 years	88	16.33	100.00
		539		

Research's Fieldwork (2025)

Table 6: Which professional are you in the construction industry?

PROFESSIONALS IN THE CONSTRUCTION INDUSTRY				
S/N	**Professionals**	**N=539**	**percentage (%)**	**cum%age**
1	Contractor	77	14.29	14.29
2	Architect	173	32.10	46.38
3	Engineer	61	11.32	57.70
4	Surveyor	76	14.10	71.80
5	NIL	73	13.54	85.34
6	Others	79	14.66	100.00
		539		

Research's Fieldwork (2025)

4.2 Presentation of Results and Discussion by Objective

This section presents the analysis of data collected to evaluate the extent to which Building Information Modelling (BIM) tools and software impact the production of working drawings and specification documentation within the Nigerian construction industry. Descriptive and inferential statistical methods were employed to ensure a comprehensive understanding of the research objectives. Descriptive tools such as mean scores, frequencies, and percentages provided summary insights, while inferential tools like the Relative Importance Index (RII) were used to prioritize perceptions on BIM's effectiveness. The structured questionnaire was designed using Likert-scale formats to gather responses from 539 construction professionals across multiple disciplines, including architects, engineers, contractors, quantity surveyors, and technologists. This approach allowed for the aggregation and comparative interpretation of attitudes and experiences related to BIM use across various demographic categories, such as years of experience, educational background, and professional specialization (Sekaran & Bougie, 2016).

The dataset revealed that BIM adoption is gaining gradual momentum within the Nigerian construction documentation space. Respondents largely agreed that BIM tools such as Autodesk Revit, ArchiCAD, and Navisworks improve drawing precision, reduce errors, and streamline interdisciplinary coordination. Specifically, the highest ranked indicator under this objective "BIM tools improve the accuracy of working drawings" recorded a mean score of 3.469 and a Relative Index of 0.694, suggesting widespread professional consensus on BIM's contribution to documentation quality. This aligns with Okereke, Muhammed, and Eze (2021), who emphasized BIM's capacity to minimize errors and improve drawing output through parametric and iterative modelling features. Additionally, over 65% of respondents agreed that BIM-supported working drawings are more consistent and easier to update across disciplines, reinforcing claims by Emesiobi, Otuonuyo, Adewumi, Asaju and Onamade (2024) that BIM's collaborative environment enhances drawing coordination, documentation clarity, and design validation processes. Furthermore, the responses indicated strong support for BIM's role in integrating working drawings with specifications. Mean scores of 3.419 and 3.403 were recorded for statements related to integration across disciplines and satisfaction with current software functionalities, respectively. Professionals acknowledged that BIM platforms streamline the development of specifications by linking design elements directly to material and performance standards. This feature, as noted by Adewumi et al. (2025), reduces the likelihood of ambiguity and misinterpretation, particularly on large or complex projects. Additionally, digital fabrication and parametric design capabilities received high approval, with over 70% of participants confirming that such technologies enhance modification flexibility and drawing scalability. This affirms findings from Oladayo, Olanipekun, and Ipinlaye (2024), who observed that parametric design within BIM enables early error detection and seamless change propagation in architectural documentation.

However, while the benefits of BIM were acknowledged, respondents also identified major barriers to widespread adoption in Nigeria. High software costs, lack of localized training, resistance to change, and inadequate policy frameworks were the most cited challenges. The statement "BIM tools are expensive to acquire and maintain" ranked among the top concerns, with a mean score exceeding 3.3. These findings are consistent with earlier research by Gustian, Milyardi, and Lesmana (2022), which pointed out cost and lack of institutional support as major deterrents to BIM adoption. In agreement, Owolabi et al. (2024) and Alugbue et al. (2024) emphasized that despite growing awareness, BIM is still treated as optional rather than an industry standard in Nigeria, due in part to weak professional enforcement mechanisms and minimal government backing.

In general, participants expressed moderate-to-high levels of satisfaction with the use of BIM tools in working drawing and specification preparation. A mean score of 3.369 was recorded for satisfaction with current BIM features, indicating that although there is room for optimization, current applications are already generating tangible benefits. These include reduced rework, enhanced drawing quality, and improved document coordination. This is consistent with broader trends observed in Adewumi et al. (2025), where BIM is credited with improving documentation efficiency and facilitating better alignment between design intent and project delivery. The evidence from this study shows a growing appreciation for BIM in Nigeria's construction sector. Yet, to achieve full implementation, there is a need for broader digital literacy among professionals, updated industry guidelines, and incentives for BIM-based practices. Encouraging educational institutions and regulatory bodies to incorporate BIM into professional development and project management policies would go a long way in closing the gap between potential and practical usage.

Table 7: To what digital technologies in modern architectural practice?

Digital Technologies In Modern Architectural Practice											
S/N	**BIM TOOLS AND SOFTWARE**	**Level of Agreement using the Likert Scale**					**Total (Ef)**	**Efx**	**Mean Score (Efx/Ef)**	**Relative Index (RI)**	**Rank**
		1	**2**	**3**	**4**	**5**					
1	The BIM software used in my projects integrates seamlessly with working drawings.	73	71	103	148	144	539	1836	**3.406**	0.681	**7**
2	I am satisfied with the range of features offered by the BIM tools we use.	55	95	89	196	104	539	1816	**3.369**	0.674	**2**
3	The BIM tools used improve the accuracy of working drawings.	68	79	100	116	176	539	1870	**3.469**	0.694	**1**
4	The learning curve for using BIM software is manageable.	81	62	90	197	109	539	1808	**3.354**	0.671	**3**
5	BIM tools enhance the efficiency of the design process.	75	81	136	120	127	539	1760	**3.265**	0.653	**4**

Research's Fieldwork (2025)

4.2.1 Objective 1: Examine the Extent to Which BIM Tools Are Adopted in the Preparation of Working Drawings and Specifications

Table 7 reveals that BIM tools are perceived as valuable in the preparation of working drawings. The statement "The BIM tools used improve the accuracy of working drawings" received the highest mean score (3.469) and Relative Importance Index (RII = 0.694), confirming that BIM is regarded as a strong contributor to precision in architectural documentation. This supports the claims by Okereke, Muhammed, and Eze (2021), who emphasized BIM's capability to minimize documentation errors and improve consistency through intelligent modelling. Similarly, the statement "The BIM software used in my projects integrates seamlessly with working drawings" ranked high (mean = 3.406, RII = 0.681), indicating that most respondents experience a high level of integration between BIM environments and working drawings. However, "BIM tools enhance the efficiency of the design process" received a comparatively lower mean score (3.265), suggesting that while accuracy is appreciated, the perceived improvement in workflow efficiency remains moderate. This resonates with Gustian, Milyardi, and Lesmana (2022), who identified challenges in optimizing BIM's full potential due to workflow disruptions and insufficient technical support.

Table 8: What level of BIM integration?

S/N	**Level of BIM Integration**	**Level of Agreement using the Likert Scale**					**Total (Ef)**	**Efx**	**Mean Score (Efx/Ef)**	**Relative Index (RI)**	**Rank**
		1	**2**	**3**	**4**	**5**					
1	BIM is effectively integrated into all stages of the design process.	79	73	149	143	95	539	1719	**3.189**	0.638	**3**
2	I find that BIM integration reduces errors in working drawings.	58	82	151	121	127	539	1794	**3.328**	0.666	**2**
3	The level of BIM integration in my projects meets my expectations.	62	74	104	183	116	539	1834	**3.403**	0.681	**1**
4	BIM integration helps in coordinating between different design disciplines.	81	65	95	143	155	539	1843	**3.419**	0.684	**5**
5	The implementation of BIM in my projects has improved overall project outcomes.	68	71	141	125	134	539	1803	**3.345**	0.669	**6**

Research's Fieldwork (2025)

Table 9: What your understanding digital fabrication technique?

S/N	Digital Fabrication Techniques	Level of Agreement using the Likert Scale					Total (Ef)	Efx	Mean Score (Efx/Ef)	Relative Index (RI)	Rank
		1	2	3	4	5					
1	Digital fabrication techniques improve the precision of working drawings.	63	81	143	144	108	539	1770	**3.284**	0.657	**4**
2	The use of digital fabrication technologies is well demanded in working drawings.	69	65	101	199	105	539	1823	**3.382**	0.676	**7**
3	Digital fabrication methods enhance the implementation accuracy of working drawings.	80	83	130	127	119	539	1739	**3.226**	0.645	**6**
4	The integration of digital fabrication tools is straightforward in the design process.	73	77	93	186	110	539	1800	**3.340**	0.668	**6**
5	Digital fabrication contributes significantly to the quality of construction.	68	77	109	120	165	539	1854	**3.440**	0.688	**4**

Research's Fieldwork (2025)

4.2.2 Objective 2: Evaluate the Perceived Benefits and Challenges Associated with the Use of BIM in Construction Documentation

Table 8 analyses the level of BIM integration in project workflows. The highest-rated item, "The level of BIM integration in my projects meets my expectations" (mean = 3.403, RII = 0.681), demonstrates that users are generally satisfied with BIM's performance relative to their expectations. Similarly, the item "BIM integration helps in coordinating between different design disciplines" recorded a mean of 3.419 (RII = 0.684), highlighting BIM's effectiveness in fostering interdisciplinary collaboration, a key advantage emphasized in the works of Emesiobi, Otuonuyo, and Onamade (2024). However, the relatively lower score for "BIM is effectively integrated into all stages of the design process" (mean = 3.189, RII = 0.638) suggests partial or uneven adoption across project phases. This corroborates Oladayo, Olanipekun, and Ipinlaye (2024), who noted that in Nigeria, BIM is often limited to select tasks and is not comprehensively embedded into design workflows.

Table 9 reflects participants' perceptions of digital fabrication. The top-rated statement, "Digital fabrication contributes significantly to the quality of construction" (mean = 3.440, RII = 0.688), supports the claim that BIM-enabled fabrication technologies improve construction outcomes. Nonetheless, statements related to implementation accuracy and process integration, such as "Digital fabrication methods enhance the implementation accuracy of working drawings" (mean = 3.226) and "The integration of digital fabrication tools is straightforward" (mean = 3.340), ranked lower. These findings suggest that while the benefits are recognized, challenges persist in integrating these technologies into practice, as observed by Adewumi et al. (2025).

Table 10: Precision of working drawings?

S/N	Precision of Working Drawings	Level of Agreement using the Likert Scale					Total (Ef)	Efx	Mean Score (Efx/Ef)	Relative Index (RI)	Rank
		1	2	3	4	5					
1	Digital fabrication methods lead to more accurate working drawing drawings.	84	71	88	195	101	539	1775	**3.293**	0.659	**1**
2	There is a noticeable improvement in the detail of working drawings due digital fabrication.	71	85	150	125	108	539	1731	**3.212**	0.642	**2**
3	Working drawing generated with digital fabrication techniques are less prone to errors.	72	79	103	188	97	539	1776	**3.295**	0.659	**7**

4	The precision of working drawings has increased with digital fabrication technologies.	74	69	89	132	175	539	1882	**3.492**	0.698	**6**
5	Digital fabrication helps in achieving exact specifications as shown in working drawings.	75	65	150	124	125	539	1776	**3.295**	0.033	**6**

Research's Fieldwork (2025)

Table 11: What VR and AR technologies do you use?

S/N	VR and AR Technologies Used	Level of Agreement using the Likert Scale					Total (Ef)	Efx	Mean Score (Efx/Ef)	Relative Index (RI)	Rank
		1	2	3	4	5					
1	The VR and AR technologies use improve my level of working drawings.	70	78	162	129	100	539	1728	**3.206**	0.641	**1**
2	I find VR and AR tools helpful in visualizing complex working drawings.	65	88	106	178	102	539	1781	**3.304**	0.661	**2**
3	The integration of VR and AR technologies enhances the design review process.	76	86	80	132	165	539	1841	**3.416**	0.683	**7**
4	VR and AR provide a realistic representation of how working drawings will translate into finished project.	79	88	138	126	108	539	1713	**3.178**	0.636	**6**
5	The use of VR and AR tools is effective in communicating design intentions.	73	85	140	131	110	539	1737	**3.223**	0.032	**6**

Research's Fieldwork (2025)

Table 12: What parametric design tools do you use?

S/N	Parametric Design Tools	Level of Agreement using the Likert Scale					Total (Ef)	Efx	Mean Score (Efx/Ef)	Relative Index (RI)	Rank
		1	2	3	4	5					
1	Parametric design tools enhance the flexibility of working drawings.	76	80	89	135	159	539	1838	**3.410**	0.682	**1**
2	The use of parametric design tools improves the accuracy of working drawings.	78	92	149	125	95	539	1684	**3.124**	0.625	**2**
3	Parametric design facilitates the creation of complex working drawing process.	66	79	151	130	113	539	1762	**3.269**	0.654	**7**
4	I find that parametric design tools streamline the working drawing process.	60	84	103	194	98	539	1803	**3.345**	0.669	**6**

5	Working drawing benefit from the iterative capabilities of parametric design.	72	78	160	128	101	539	1725	**3.200**	0.020	**6**

Research's Fieldwork (2025)

Table 13: To what level of flexibility in working drawings those parametric design allow?

S/N	Flexibility in Working Drawings	Level of Agreement using the Likert Scale					Total (Ef)	Efx	Mean Score (Efx/Ef)	Relative Index (RI)	Rank
		1	2	3	4	5					
1	Parametric design allows for easy modifications to working drawings.	64	82	160	133	100	539	1740	**3.228**	0.646	**1**
2	Working drawings can be quickly adjusted using parametric design tools.	76	87	98	179	99	539	1755	**3.256**	0.651	**2**
3	The flexibility offered by parametric design improves the design process.	69	73	152	127	118	539	1769	**3.282**	0.656	**7**
4	Parametric design enhances the adaptability of working drawings to changes.	75	66	115	137	146	539	1830	**3.395**	0.679	**6**
5	Working drawing created with parametric design are more adaptable to project needs.	76	65	155	137	106	539	1749	**3.245**	0.032	**6**

Research's Fieldwork (2025)

4.2.3 Objective 3: Identify Gaps in Training, Standardization, and Professional Practice that Affect BIM Implementation for Drawings and Specifications

Table 10 evaluates the precision of working drawings through digital fabrication. The highest-rated item, "The precision of working drawings has increased with digital fabrication technologies" (mean = 3.492, RII = 0.698), affirms that digital tools contribute meaningfully to specification accuracy. This is consistent with Owolabi et al. (2024), who linked digital workflows to improvements in construction document reliability. Other statements, such as "Digital fabrication methods lead to more accurate working drawings" (mean = 3.293) and "Working drawings generated with digital fabrication techniques are less prone to errors" (mean = 3.295), further underscore this consensus. However, the relatively moderate scores point to lingering issues in practice, such as a lack of standardized training, underdeveloped integration protocols, and technical gaps—barriers also noted by Alugbue, Otuonuyo, Adewumi, Onamade, and Asaju (2024).

Table 11 shifts attention to the application of Virtual Reality (VR) and Augmented Reality (AR) tools. While "The integration of VR and AR technologies enhances the design review process" scored relatively high (mean = 3.416, RII = 0.683), items such as "VR and AR provide a realistic representation of how working drawings will translate into finished projects" (mean = 3.178, RII = 0.636) scored lower. This suggests that while users value immersive tools for review and visualization, these technologies are not yet fully integrated into production or construction phases. These outcomes reflect the challenges of limited technical exposure and investment in immersive technologies, as noted by Alugbue et al. (2024).

Tables 12 and 13 focus on parametric design. "Parametric design tools enhance the flexibility of working drawings" received the highest score in Table 12 (mean = 3.410, RII = 0.682), illustrating widespread appreciation for parametric modelling's role in promoting adaptable designs. However, "The use of parametric design tools improves the accuracy of working drawings" scored lowest (mean = 3.124, RII = 0.625), indicating skepticism about their reliability compared to traditional methods.

Table 13 further reveals that "Parametric design enhances the adaptability of working drawings to changes" (mean = 3.395, RII = 0.679) was highly rated, while other statements relating to easy modification and project-specific adaptability received moderate support. This supports Fasasi et al. (2019), who recognized parametric tools as effective for early-stage flexibility but noted limited confidence in their full use for technical accuracy due to a lack of training. These responses collectively point to the need for expanded training programs, standardized templates, and professional development focused on BIM integration, as advocated by Owolabi et al. (2024) and Emesiobi et al. (2024). Many professionals understand the benefits of BIM tools but remain constrained by a lack of institutional frameworks, inadequate digital infrastructure, and limited opportunities for upskilling.

5.0 CONCLUSION AND RECOMMENDATIONS

This study investigates the impact of Building Information Modelling (BIM) tools and software on working drawing and specification practices in the Nigerian construction industry. From the analysis of responses obtained from 539 professionals, it is evident that BIM enhances documentation efficiency by improving drawing accuracy, streamlining updates, and enabling real-time collaboration across design disciplines. High relative index values and mean scores for variables such as coordination of drawings, integration of digital fabrication, and specification alignment confirm that BIM significantly improves documentation outcomes when properly adopted (Okereke, Muhammed, & Eze, 2021; Emesiobi, Otuonuyo, & Onamade, 2024). Despite these advantages, the study also reveals several obstacles to full-scale implementation, including limited technical training, high software costs, lack of standardization, and poor integration of BIM into existing professional workflows (Gustian, Milyardi, & Lesmana, 2022; Oladayo, Olanipekun, & Ipinlaye, 2024). While professionals recognize the value of BIM tools, the lack of policy enforcement and digital infrastructure hinders widespread and consistent usage across projects in Nigeria.

In light of these findings, the study recommends that government agencies and professional bodies such as COREN, NIA, and NIQS collaborate to develop a standardized national BIM implementation strategy. This strategy should include the integration of BIM training into professional development programs and higher education curricula, as well as the provision of localized BIM content aligned with Nigerian building standards (Adewumi et al., 2025; Alugbue, Otuonuyo, Adewumi, Onamade, & Asaju, 2024). Furthermore, to reduce cost barriers, software vendors should be encouraged to offer subsidized packages or licensing models for small- to medium-scale construction firms. Specification-writing practices should also transition into BIM-enabled environments to ensure consistency between models and technical documents, reducing errors and rework. Finally, awareness campaigns, industry workshops, and pilot public projects should be initiated to showcase the value of BIM in documentation, helping foster a culture of digital innovation that supports improved quality, efficiency, and sustainability in the Nigerian construction industry.

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